1 Understanding Gravity in Pi-Space

In this chapter, we begin to lay the foundations of how to model Gravity within Pi-Space. In the earlier chapter, explaining the Introduction to Pi-Space we were mostly modeling velocity and total energy and how it related to Special Relativity. Einstein did not apply acceleration to Special Relativity so in this section we begin to model Pi-Shells gaining and losing area over time t and distance h. Also, we investigate the well-known Newtonian formulas related to Gravity and show how the Pi-Shells are affected. From this we can begin to understand the meaning of Kinetic and Potential Energy. Mainly there are a lot of diagrams here. However, we also introduce how Cosine, Sine and Tan relate to Pi-Space and begin the task of bringing Trigonometry into Pi-Space. This is later used to explain how to derive the Advanced Formulas. The Doppler Effect is also explained and this is important as we understand the relationship between wave change and Pi-Shell area change. There is a later follow up chapter on Gravity as well covering the ideas of the Gravity Field versus the Gravity Force before the Advanced Formulas piece.

1.1 Different Pi-Space Diagram Types and Their Uses

There are three types of Pi-Shell diagrams as I’ve shown already, each of which are useful for describing different types of Physics situations. The diagrams types are

(a) Absolute Pi-Shell diagrams (no Observer Pi-Shell at all)
(b) Newton: Non-relative Pi-Shell diagrams (compare to a single Observer Pi-Shell)
(c) Einstein: Relative Pi-Shell diagrams (compare to more than one Observer Pi-Shell)

Absolute Pi-Shell diagrams are the easiest to understand in that they contain *no concept of the Observer*. Pi-Shells either get larger or smaller or stay the same size over a distance. These types of diagrams are useful for showing a Gravity field such as a planet's atmosphere; as one moves towards the center of Gravity, the Pi-Shells become smaller. I'll explain this shortly. However, they cannot help describe a traditional velocity which is what we all use from day because there is no observer Pi-Shell from which measurements are taken and means they are not very scientifically useful in terms of taking measurements. They are also useful for showing compression within fixed object which are not necessarily moving but experiencing stresses and strains.

Non-relative Pi-Shell diagrams are useful for portraying the Newtonian viewpoint because they show measurement *in terms of an Observer*. They therefore can be mapped to the speed, distance and time framework as Newton laid out. Their flaw as I've shown is that all relative diameter measurement are described in terms of the initial observer's Pi-Shell. The Einstein relative Pie Shell diagrams are the most complex and are useful for accurately describing the proportion of Pi-Shell change relative to an observer and thus translate to an accurate velocity.

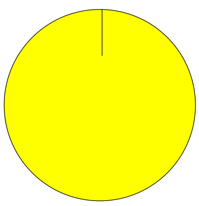
1.2 Extending the Pi-Shell Notation

Currently, the Observer based Pi-Shell examples I have shown only cover Pi-Shells which get smaller in relation to the Observer. This is because when mass moves it gets smaller. Also, we do not have the concept of the vector of movement. Let's add these properties to the Observer based Pi-Shells. In order to understand Gravity, this extended notation is required. You might wonder, how does a Pi-Shell become bigger? This will be explained in this chapter relating to Gravity and I will map it to the existing Physics' concept of Potential Energy. First let's show some simple cases to explain the enhanced notation.

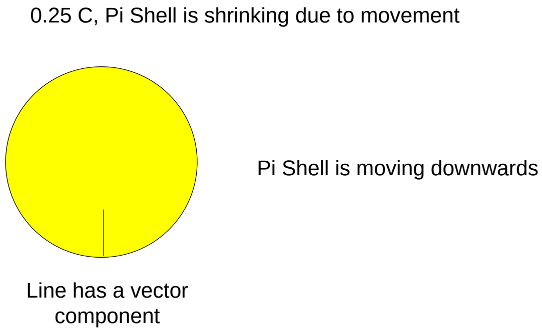
NB: The vector direction of the Pi-Shell movement is the Normal to the surface of the Pi-Shell diameter line. An inward pointing diameter line represents compression of the Pi-Shell (faster relative movement) and an outward pointing line represents decompression of the Pi-Shell (slower relative movement).

1.3 Vectors and Pi-Shells Getting Larger

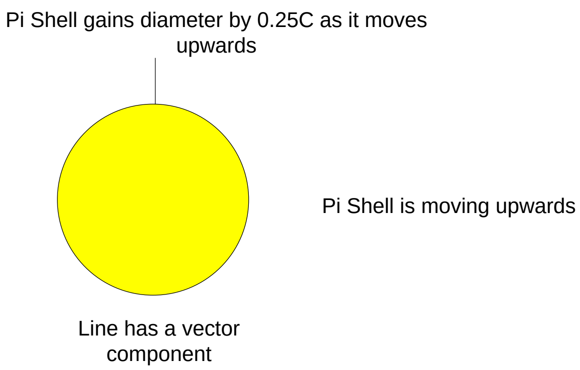
Case 1: A Pi-Shell moving upwards and getting smaller.



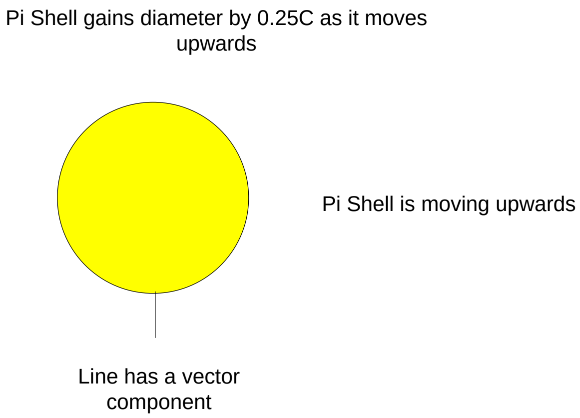
Case 2: A Pi-Shell moving downwards and getting smaller



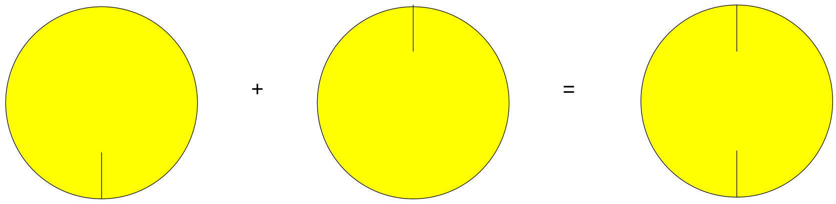
Case 3: A Pi-Shell moving upwards and getting larger



Case 4: A Pi-Shell moving downwards and getting larger



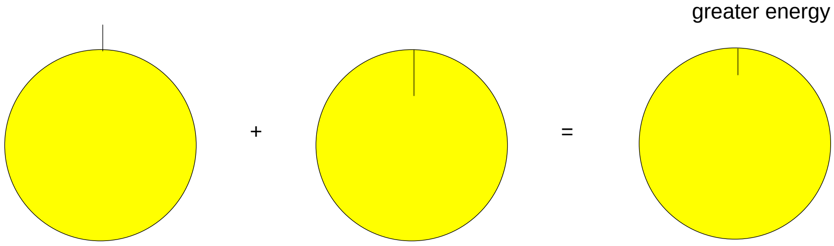
Case 5: Adding Pi-Shell diagrams together



Kinetic Energy going down (faster 0.25 C)

Kinetic Energy going up (faster 0.25 C)

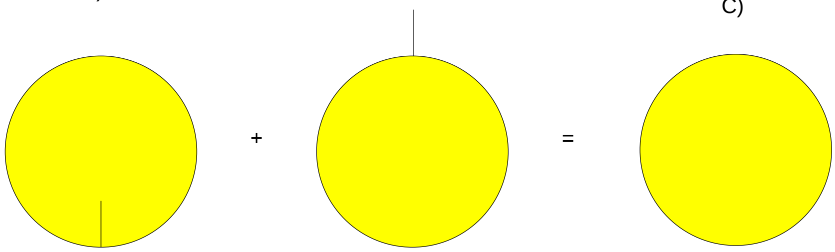
Vector forces cancel out but Pi Shell has double compression (0.50 C) = greater energy



Pi Shell growing larger as one moves up (slowing 0.125C)

Kinetic Energy going upwards (faster 0.25 C)

Pi Shell moves upwards and Pi Shell partially compressed (faster 0.125 C)

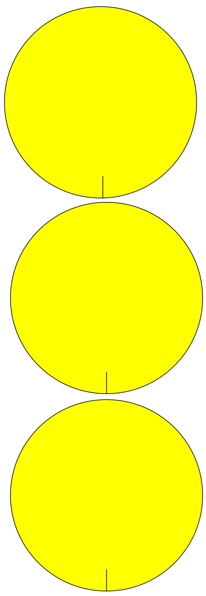


Kinetic Energy going down (faster 0.25 C)

Potential Energy going up (slower 0.25 C)

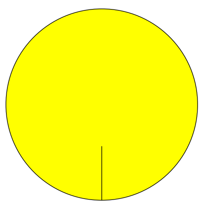
Vector forces cancel out no compression

Case 6: Using the notation to show summing changes in a Pi-Shell over a distance



Three Pi Shells, each wishing to move downwards with equal force

=



Total force is a sum of their individual forces

1.4 Relating Pi-Shells to Sin, Cos and Tan

So how do we model more than one force on a Pi-Shell in which the force comes in at an angle? To model this, we first need to understand Cos, Sin and Tan and how they can be applied to Pi-Space.

Trigonometry must be part of Pi-Space in order for Pi-Space to be a valid theory. So, how does Cos, Sin and Tan fit into Pi-Space? Many of the standard Trigonometry formulas are essentially Pi-Space formulas. They are describing the change in area of a Pi-Shell in terms of its diameter and its area. I've already shown from the Lorenz-Fitzgerald transformation which uses Pythagoras' Theorem that it is a Pi-Space Theorem. The foundational Trig formula which is a Pi-Space formula is

$$Sin^2 x + Cos^2 x = 1$$

This can be related to a right-angled triangle where the Observer Pi-Shell is sized 1 using relativity. I've shown that a right angled triangle is essentially Pi-Shell addition. Therefore, two Pi-Shells when added together combined to form another Pi-Shell whose area is the same as the Hypotenuse Pi-Shell. Let's call the other two Pi-Shells the Cos Pi-Shell and the Sin Pi-Shell. What is the difference between the Cos Pi-Shell and the Sin Pi-Shell? Well, both Pi-Shells are measured in terms of their diameter change. So the result of either Cos x or Sin x is a value which is related to the proportional diameter change in terms of the Hypotenuse Pi-Shell. If one squares these result values, then one is dealing with the proportional area change in terms of the Hypotenuse Pi-Shell. The value of Cos x and Sin x are non-linear because we're dealing with a change in a Sphere whose area change is a function of Pi times the radius squared. Essentially Cos x and Sin x are essentially how one counts in Pi-Space. In our reality, we count 1, 2, 3, 4, 5, 6 and so forth when we count upwards. We also count 6, 5, 4, 3, 2, 1 when we count downwards. Sin x is counting upwards (in terms of area gain) in Pi-Space. We start at 0 and move up to 1. If the value is not squared, we're dealing with the Pi-Shell area change represented in terms of the diameter of the Hypotenuse Pi-Shell. If the value is squared, we're dealing with the area change in terms of the Hypotenuse Pi-Shell. The reason why we don't go beyond 1 is we're using an Observer Pi-Shell whose default size is 1. We can apply a scaling factor which is commonly done. Cos x is counting downwards (in terms of area) in Pi-Space. We start at 1 and move down to 0. Once again, the reason why we don't go beyond 1 is we're representing these values in terms of Hypotenuse Pi-Shell whose relativistic value is 1. So the above formula maps to…

$$Sin^2 x + Cos^2 x = 1$$

$$SinPiShellAreaGain + CosPiShellAreaLoss = TotalHypotenusePiShellArea$$

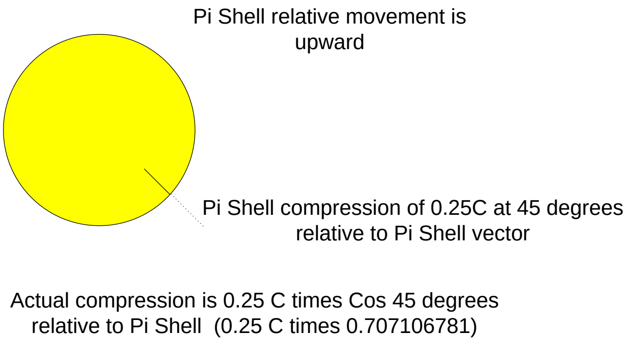
So why don't we just count upwards? Why do we need both Cos x and Sin x? We need the two of them for the same reason we need addition and subtraction. If we only had addition, we couldn't go backwards in our calculations so to speak. Also, because we're dealing with a Pi-Shell, we can represent sequences in term of angles and/or polar co-ordinates. The input term is linear such as an angle from 0 to 360 or radians which are also linear. However, the result is non-linear and is a Pi-Space value.

Sin x represents the area gain of a Pi-Shell relative to the Hypotenuse Pi-Shell

Cos x represents the area loss of a Pi-Shell relative to the Hypotenuse Pi-Shell

The reason why Cos x and Sin x are used across Math, Engineering and Physics is that they deal with area change and this maps to all known forces in our reality as we live inside a Pi-Shell based reality.

If we take for example, the collision between two Pi-Shells A and B at an angle of 45 degrees how can we calculate the area change on the Pi-Shell being collided with? Should we use Cos x or Sin x for the calculation? A simple rule of thumb is: *Use Cos for Compression.* The Pi-Shell being acted on is being compressed. Therefore, if we have a force of 0.25 C colliding with a Pi-Shell at a relative angle of 45 degrees, it turns out that the diameter change is 0.25 C times Cos 45 degrees. Please remember that that all Pi-Shells have an implicit vector component due to Newton's First Law. The collision vector is relative to that implicit vector component.



Note that the other Pi-Shell which collides glances off the other Pi-Shell at 45 degrees. It slows a little and therefore decompresses, so we use Sin 45 degrees to calculate its new speed which is also 0.25 C times Sin 45 degrees. You might be inclined to think the answer should be 1 – Cos 45 degrees but don't forget you're dealing with the diameter representation of an area change. Therefore we end up with a Trig solution where

$$Sin^2 x + Cos^2 x = 1$$

This produces

$$Sin^2 x = 1 - Cos^2 x$$

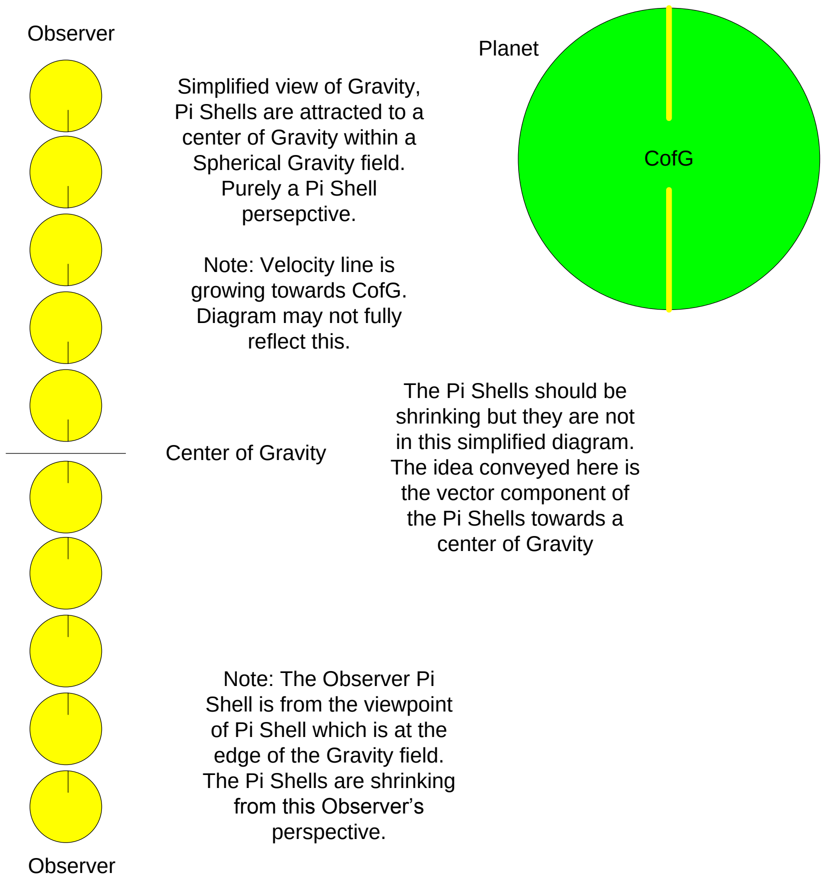
A general application of this idea can be found in Physics with the formula for work

$$Work = F.Cos\theta.d$$

I reiterate once more, Cos is for calculating Pi-Shell Compression.

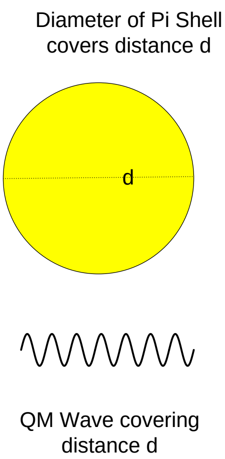
So how does Tan fit into this Pi-Space view? Tan is Sin over Cos. Therefore Tan is the area gain divided by the area loss. If both are equal, then you're dealing with a 45 degree angle. So, 45 degrees is two Pi-Shells of the same size. A relative gain in Pi-Shell area means a larger Pi-Shell and thus a slower one relatively speaking.

1.5 Gravity Field from a Pi-Shell perspective



1.6 Defining Distance in terms of a Pi-Shell and a QM Wave

A Pi-Shell Gravity sequence defines the change in size of a Pi-Shell in a particular direction. Each Pi-Shell has a diameter d. A Quantum Mechanical wave also covers distance d but has no diameter.



The important point to note here is that total distance is easier to calculate with a QM wave because as you need to know is the wavelength, rather than a Pi-Shell because you need to

count the Pi-Shells and add up the size of the individual Pi-Shell diameters. In a Gravity Field, the Pi-Shell diameter is different depending on where you are in Relation to the Center of Gravity. This is also true for a QM wave (traveling at speed C) but it's the wavelength that changes here.

1.7 Picking an appropriate diameter size for a Pi-Shell

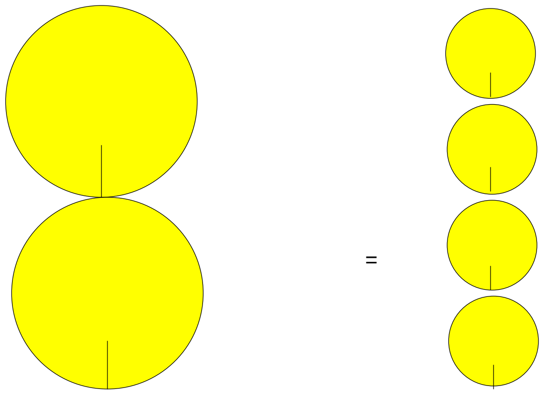
Pi-Shells are very small. So this means we could have anything up to 10^{-8} Pi-Shells per cm. If one wants to write a software program to simulate this number of Pi-Shells, one quickly sees that one cannot realistically simulate this number of Pi-Shells on a software program as you'd run out of processing power and memory just trying to simulate only a tiny space! However, this is where Pi-Shells have a powerful feature based on their properties which is called the Pi-Shell Principle of Equivalence.

Recall earlier that this Principle of Pi-Shell Equivalence was used in solving Pythagoras' Theorem. The idea is that one can generalize a collection of tiny Pi-Shells into a larger single Pi-Shell and that they are equivalent. So what use is this to us?

What this means is that even though the actual size of a Pi-Shell is theoretically $10^{-8\ cm}$ we can pick larger sized Pi-Shells of say 1mm but which are equivalent for the purposes of simulation. This makes the Pi-Space Theory very powerful for simulating on computers with limited memory and processing power and makes the idea of using this idea applicable to even commercial games engines on modern PCs. The analogy would be a little like camera DPI or Dots Per Inch. We can choose the level of granularity we like based on our processing power. Later, I'll show how Newton used the Pi-Shell Principle of Equivalence to represent the whole planet as a single Pi-Shell and from there calculate the Gravitational Gradient. This is an extreme example admittedly but it shows this principle clearly. Newton did not have to count up every atom to calculate the Gravitational Constant of a Planet with weak Gravity!

Let's take a simple example of a Pi-Shell sequence representing Gravity. Gravity is acceleration, *so there is additional g/C compression of the Pi-Shells every distance g moving towards the center of Gravity*. (Note: This is almost true for a weak Gravity field and we can use the Einstein SR Lorenz Transformation to compensate if one prefers to be more accurate.) Therefore, the 'n' Pi-Shells spanning distance g are each diameter shrinking by g/n. We can choose 10 Pi-Shells or 10 billion Pi-Shells.

For a computer application one might choose the diameter of each Pi-Shell to be 1mm, so with g=9.8m/s/s this means there would be 9800 Pi-Shells each with 1mm and whose diameters are shrinking by (g/C)/n where n=9800.



2 Pi Shells each with double the compression of the smaller Pi Shells

4 Pi Shells each with half of the compression of the larger Pi Shells

Both sequences have equivalent compression. Note: Do not confuse this with the Einstein Equivalence Principle!

1.8 Measuring the Diameter of a Pi-Shell

An important question to ask is what is the actual (absolute) diameter of a Pi-Shell? Is it the diameter of an atom? Diameters of atoms vary from 10^{-8} to 10^{-11} depending on the number of electrons they have. In Pi-Space, we are not using the diameter of an atom what we are using *is the diameter of the volume of the Pi-Shell.* One might be inclined to think these are the same things but they're not. A famous story featuring Archimedes of Syracuse illustrates how volume measurement works under Gravity.

1.9 The story of Hiero's Crown/Wreath

In the story Hiero II heard a rumor that the Goldsmith who made his crown had secretly added silver to the mix. He tasked Archimedes to find out if it were true or not. As the story goes, Archimedes took a bath and had his famous Eureka! Moment where he ran naked through the streets proclaiming he had found the answer. There are many who believe that this is a buoyancy story but in Pi-Space Archimedes discovered a very important principle which is clear from the Pi-Space diagrams.

The principle is that at distance d from the center of a Gravity field all mass displaces the same volume.

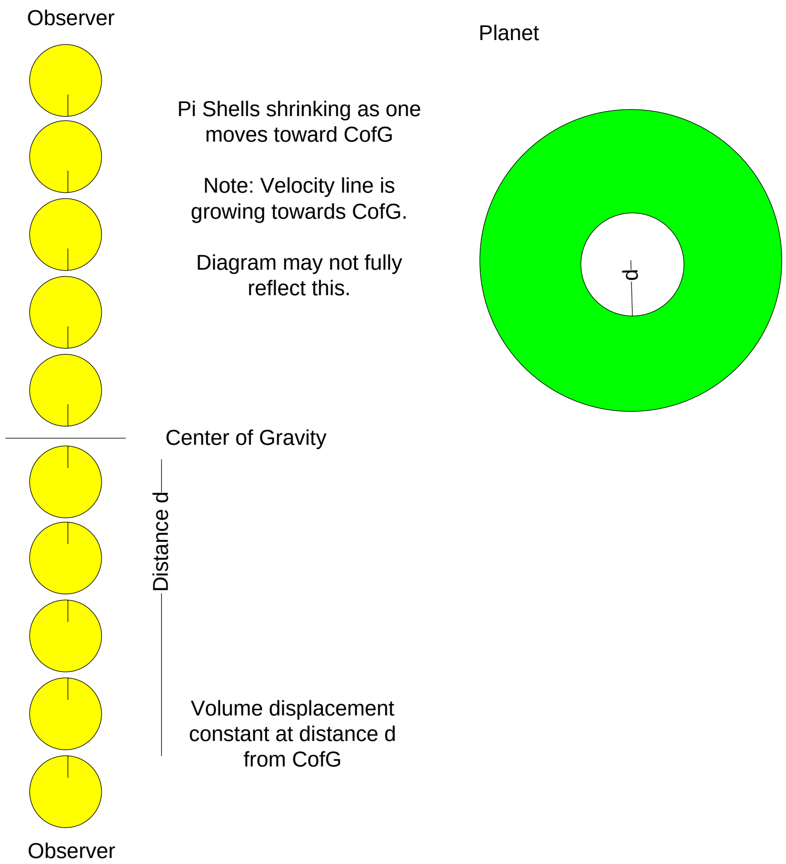
Archimedes realized that if he were made of gold or just skin and bones he would still displace the same volume of water. He then realized, if he were made of gold and silver combined he would also displace the same volume. *However, all volumes have different weights*. Volume is a constant. Eureka!

So all Archimedes needed to do was express the volume displacement of the crown in terms of water and then get the same volume of pure gold. If the crown was made of pure gold the

two (crown and pure gold volume equivalent) would have the same weight. They did not weigh the same and so the Goldsmith confessed.

In Pi-Space, we see that as one moves upwards within a Gravity field, the Pi-Shells get larger. In a weak Gravity field, the rate of change of diameter is small and this is not the case for strong fields. By implication, the volume of the Pi-Shells is increasing as one moves upwards. However, if one moves along the surface of the Earth at a fixed distance from the center of Gravity, the volume displacement remains constant. Archimedes used this fact to solve the King's puzzle.

The diameter of this volume is what we are dealing with in Pi-Space.



Note: A secondary and not so obvious conclusion of this is to do with objects of different masses falling under Gravity. Galileo showed that the speed at which objects fall is independent of their weight which seems counter-intuitive but it's true as we all know. We see therefore that the velocity of an object is clearly related to an object's volume which is consistent with the Pi-Space theory. This means we can associate the volume which is a constant under Gravity at distance d from a center of Gravity to its velocity at that point.

So can the absolute volume be measured? We see that the volume is related to the velocity so what we're trying to measure is the absolute volume or absolute velocity. This goes back to the Principle of Relativity which is that one cannot measure the absolute velocity so we use an observer Pi-Shell and work from there. The same is therefore true of volume. We take an observer volume and use this to compare against.

1.10 Drawing a Weak Gravitational Field

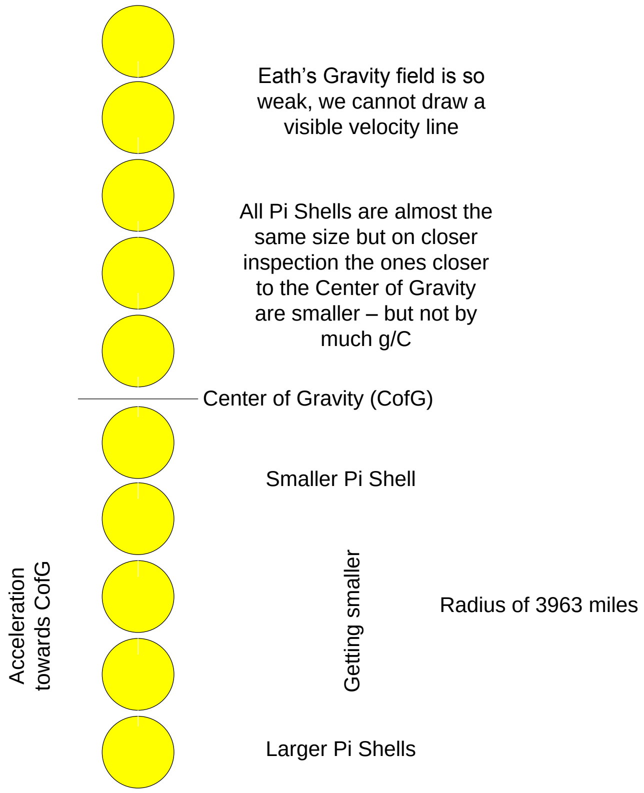
Not only is Gravity itself a weak force. There are also weak and strong Gravity fields. Earth is a 'weak Gravity field'. Let's work with this case to understand what this means in Pi-Space.

Gravity (which is acceleration in Pi-Shell terms) is 32 feet per second squared.
The diameter of Earth is 7926 miles and thus its radius is 3963 miles.
Therefore the center of Gravity of the planet is 3963 miles in from the end of the Gravitational potential. (I'll explain the Gravitational potential shortly in Pi-Shell terms.)
Earth Gravity therefore is defined by Gravity constant g which means that the Pi-Shells are decreasing in diameter by g/c per second. (There are 5280 feet in a mile and units of C are miles to be exactly precise if one uses the Imperial system.)

$$changeInPiShellDiameterTowardsCenterOfGravity\mathrm{Re}lToObserver = \frac{32}{C * 5280}$$

How can we draw this in Pi-Space? The vector line is essentially growing longer as we move towards the center of Gravity as we travel a unit of distance. However the size of the vector line is pretty much invisible and cannot be seen because it is so small. This is what a weak Gravity field is in Pi-Shell terms. For the purposes of the diagrams, I'll put a mark a white line where the vector component of the Pi-Shell force is and we'll see what the implications are on this type of Gravity field.

Using the Pi-Space Equivalence Principle, I choose a Pi-Shell whose diameter is 32 feet for this diagram. Therefore, every 32 feet there is additional compression of the Pi-Shell of g/C from the viewpoint of the Observer (notionally in Space).



Few points to note from this weak Gravity field:

[0.] Gravity appears to be a constant is not strictly correct. It only appears to be a constant. It is not. However, because the change in Gravity is so small, we approximate that it is a constant. This becomes more self-evident in the strong-Gravity case as I'll show. The change in the size of the Gravity field can be approximated to be a constant because from the diagram, one can see that all possible observers are almost the same size. However, all observers are slightly different in size and therefore the proportion change in them is slightly different.

[1.] Drawing a line from the center of Gravity to the edge of the Gravitational potential, one sees that it is not Euclidean. What I mean by this is that in Euclidean space, all Pi-Shells are assumed to be the same diameter when one forms a line but as one move upward under Gravity, the Pi-Shells are getting slightly larger.

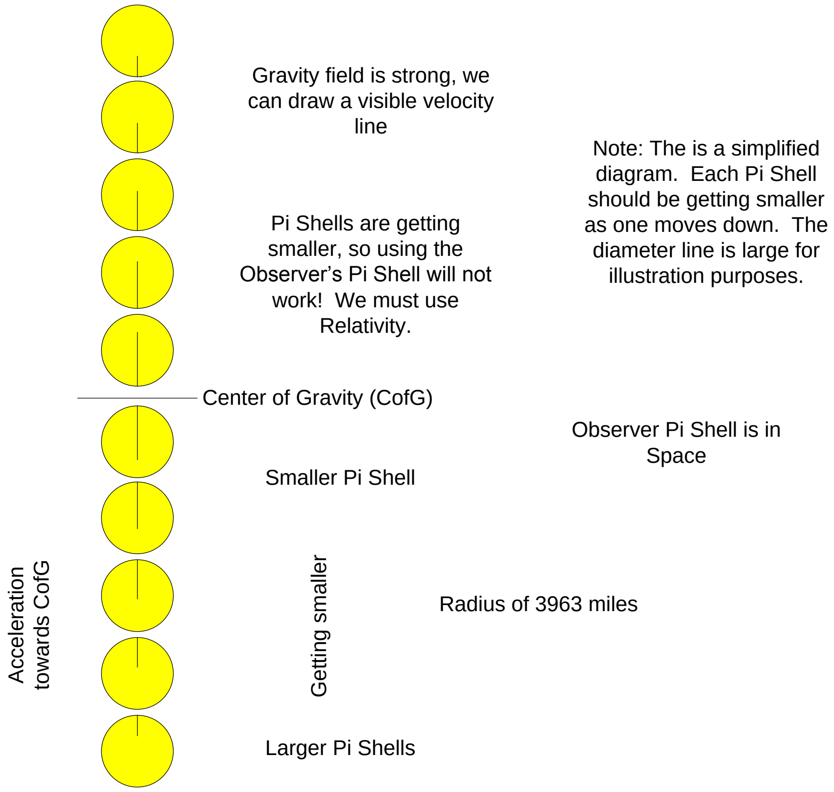
[2.] The clock tick for a smaller Pi-Shell is shorter than the clock tick for a larger Pi-Shell. Therefore as one travels towards the center of Gravity time begins to run slower. In other words, there is time dilation. I will cover this in further detail in another section.

[3.] The underlying reason for this Pi-Shell to become smaller and the vector towards the center of Gravity is to do with Pi-Shells interacting with warped Space Time. This is *not* covered in this diagram. This is purely a Pi-Shell representation of Gravity. An important point to note is that forces other than Gravity can also generate these Pi-Shell configurations.

[1], [2] and [3] are the same for both weak and strong Gravity fields.

1.11 Drawing a Strong Gravitational Field

A strong Gravitational field is as it infers; the rate of change of Pi-Shell diameter is a larger proportion of C. In Math, this is represented as v<C (Collapsar). The (simplified) diagram becomes. (Later I shall use a Computer Program to draw the Pi-Shells more precisely.)



1.12 How objects falls under Gravity

When an object falls under Gravity from one second to the next, the amount of distance it covers grows based on the Newtonian formula.

$$s = \frac{1}{2}at^2$$

We assume the starting velocity is 0. If one puts Gravity into the formula, the result is

Freefall Time (seconds)	Distance
1	g/2
2	2g
3	4.5g
4	8g

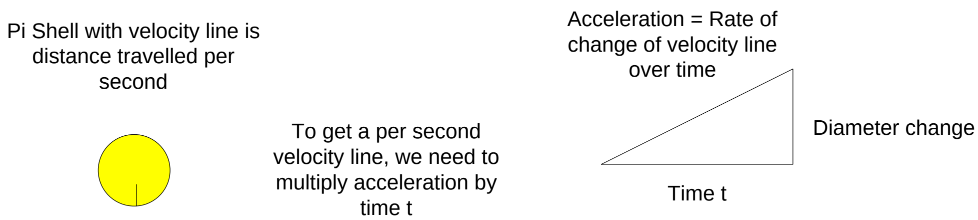
Gravity represents the amount of diameter compression after one second. The amount of diameter compression is g/C. The rate of change of velocity is based on the acceleration which is a constant (this appears to be the case for a weak Gravity field). The Newtonian formula is

$$v = at$$

Freefall Time (seconds)	Velocity	Average Velocity
1	g	g
2	2g	g
3	3g	g
4	4g	g

A Pi-Shell with a velocity line represents the amount of distance a Pi-Shell will travel in one second only.

Gravity, which is acceleration, does not represent a Pi-Shell with a velocity line. To derive a Pi-Shell with a per second velocity line from acceleration we must multiply by time t (v = a.t).   In a Gravity field the velocity line is constantly changing as it moves.

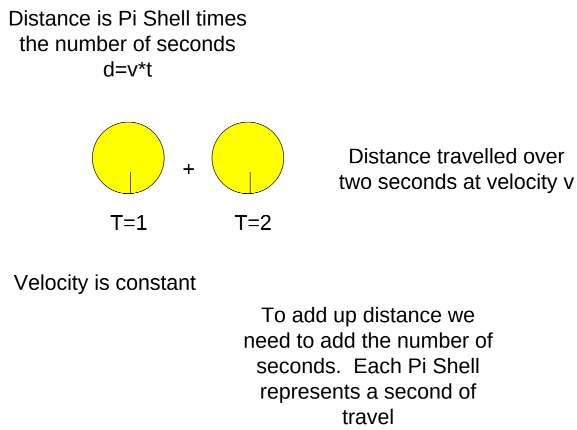


Let's derive the formula to understand it. We need velocity to calculate distance but we only have acceleration, so we can derive velocity like so

$$v_{final} = t * g$$

Also, what we want is distance

$$s = v_{average} * t$$

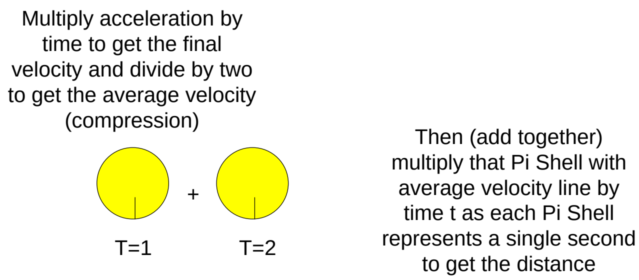


However, the velocity we have derived is the final velocity so we need the average velocity (0 to final velocity) and we use the same approach used to derive Kinetic Energy which is to divide the total velocity by two. This works for a weak Gravitational field.

$$v_{average} = \frac{v_{total}}{2}$$

Placing this into the distance formula

$$s = \frac{gt}{2} * t$$



Gravity g can be replaced by a standard acceleration ‘a’. Let’s draw this using a Pi-Space diagram. In this diagram, for clarity, we assume that the Pi-Shell has a diameter size of g/2. In reality, a Pi-Shell has a much smaller diameter than this but we can do this using the Pi-Shell Principle of Equivalence. Essentially, over distance h=g/2 there is compression g/C.h/C. We can use one large Pi-Shell with this compression or many smaller ones. The diagram uses the larger one for clarity where the unit size is the size after falling for one second.

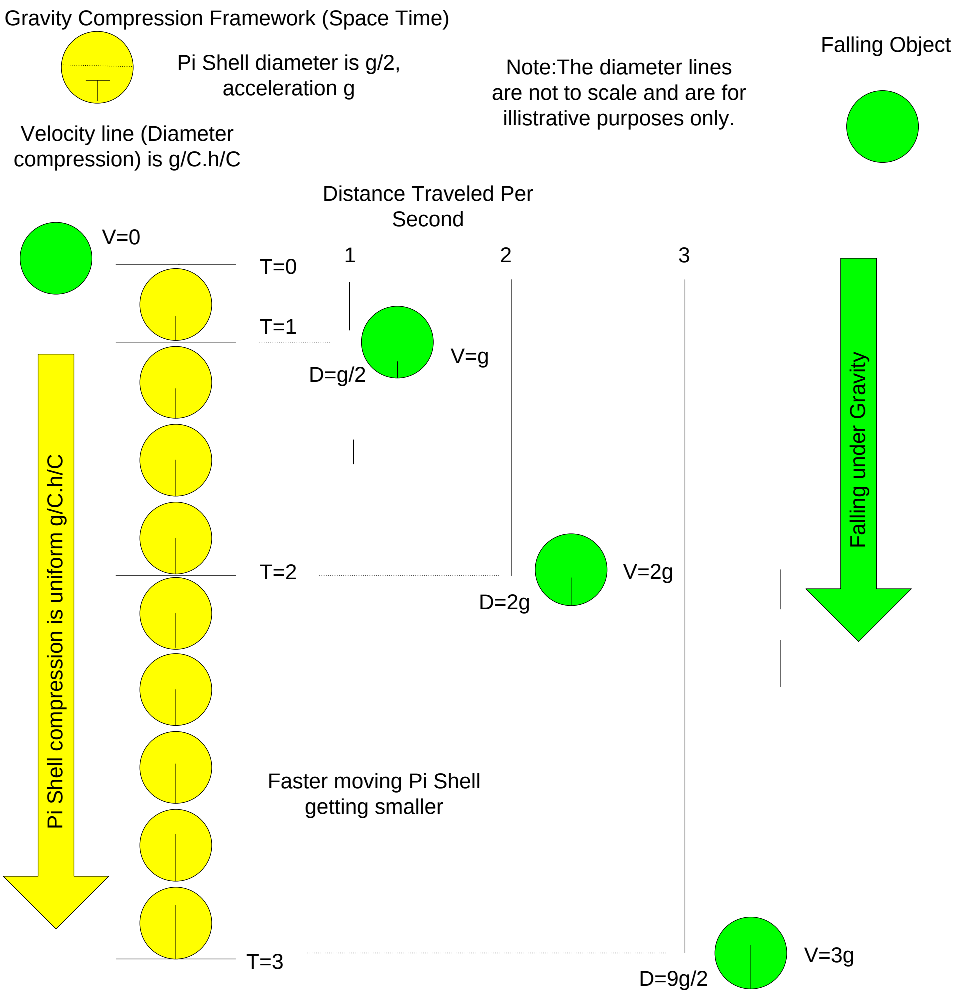
There are two distinct aspects to modeling free fall under Gravity with Pi-Shells. In the first case there is the Gravity field itself as defined by Newton and then refined to be called Space Time by Einstein. In Pi-Space, Space Time is a Pi-Shell compression framework. Space Time can be modeled using Pi-Shells whose diameters shrink by g/C.h/C over distance h. The Pi-Shells can be modeled to describe the compression framework.

Secondly, there is the free falling object itself. This can also be modeled by means of Pi-Shells. It is subject to several forces. In this case, we only handle the force of Gravity. The Pi-Shell is attracted to the Center of Gravity. Why that is so is left to another section. As it falls, its diameter shortens uniformly (in a weak Gravity field) over distance h towards the center of Gravity. It is effectively compressed by Gravity.

Newton’s formulas describe how to add up the compression and translate compression into either speed, distance or time. In the diagram, we can see that although there is g/C.h/C compression where h=g/2 in terms of Space Time over one second, the falling Pi-Shell itself has traveled distance g/2 because it started out with no compression and the average compression has been calculated in the Newtonian formulas.

An interesting point to note about the diagram is that the compression of Space Time itself is constant with respect to distance h (the height with respect to the starting point). Distance d is the distance traveled by the free falling Pi-Shell.

If one is dealing with a strong Gravity field, the fully qualified formula for Gravitational compression uses the Lorenz Transformation. This is covered under Gravitational Time dilation.



One might well ask, why is t=1 and v=g at d=g/2 as I did when I used the Newtonian formulas? I would have thought that at v=1 and t=1 that d=g. Let's work the other way, what is t at this value d=g? The answer is that t=sqrt(2). Now the square root of 2 is a very important number because it's a diameter value for the addition of two Pi-Shells sized 1 or it's 100 percent of an area, expressed in terms of a diameter. So what is t=1 as a proportion of the t=sqrt(2)? The answer again is a very interesting value. The value is 0.7071 which is half the area loss due to Gravity, expressed in terms of a diameter. At sqrt(2) seconds, one loses the full unit of area loss due to Gravity which is d=G. We are interested in half the area because this is the way that Newton linearized Gravity by calculating the average velocity and in this case, the average area loss. So this is why at t=1 and v=g, d=g/2. It's because this is the average area loss due to a unit of Gravity. Therefore, the unit of time from an area perspective is t=sqrt(2) as this is the time to lose area g**.** To cut a long story short, unit g is a measure of area loss of the observer Pi-Shell and unit t is a measure of this area expressed in terms of its diameter.

The sequence of additional Pi-Shells per second is a simple one 1, +3, +5, +7, +9, +11… and so on which maps to a Pi-Shell sum of 1, 4, 9, 16. This is because distance s is proportional to time squared.

A simple thought experiment one can conduct on this is to imagine a child standing on top of a spherical balloon with a diameter of sixteen feet. Next pop the balloon and watch the child

fall onto a safety net. How long will it take the child to reach the ground? The answer is one second. The amount of Pi-Shell compression is g/c*h/c where h=g/2. Next, setup another four balloons on top of one another and now the time to reach the ground is two seconds and so on (9 balloons, 16 balloons…). Depending on the planet's Gravity, change the diameter of the balloon to be g/2. The moon has Gravity which is one sixth of Earth so all one needs to do is imagine creating a balloon with a diameter six times larger than that on Earth to reach the ground in one second. The pattern remains the same for weak Gravity fields.

In a strong Gravity field, the size of the balloons would not be constant, gaining in size as more are added. In other words, it takes a longer distance to accelerate where v<C.

1.13 Understanding why distance s is proportional to time t squared

Galileo discovered by experimentation that the distance and object covered while falling under Gravity was proportional to time squared.

$$s \propto t^2$$

Newton further refined this to be

$$s = \frac{1}{2}at^2$$

The formulas fit the experimental data. However, why does it work out this way? Why does this relationship exist between time and distance? How can this be explained in terms of Pi-Space?

The answer to this in Pi-Space is that this relationship is linked to the Square Rule. Gravity represents a compression framework over distance h. As such, as one moves closer to the center of Gravity, the object is losing a fixed amount of Pi-Shell area. The unrealized unit of area loss is acceleration 'a' itself.

The acceleration can be turned into a velocity diameter line by means of multiplying by time.

$$v = a.t$$

Therefore time is proportional to the Pi-Shell diameter.

$$t \propto diameter$$

The acceleration can also be turned into a distance by

$$s = \frac{1}{2}at^2$$

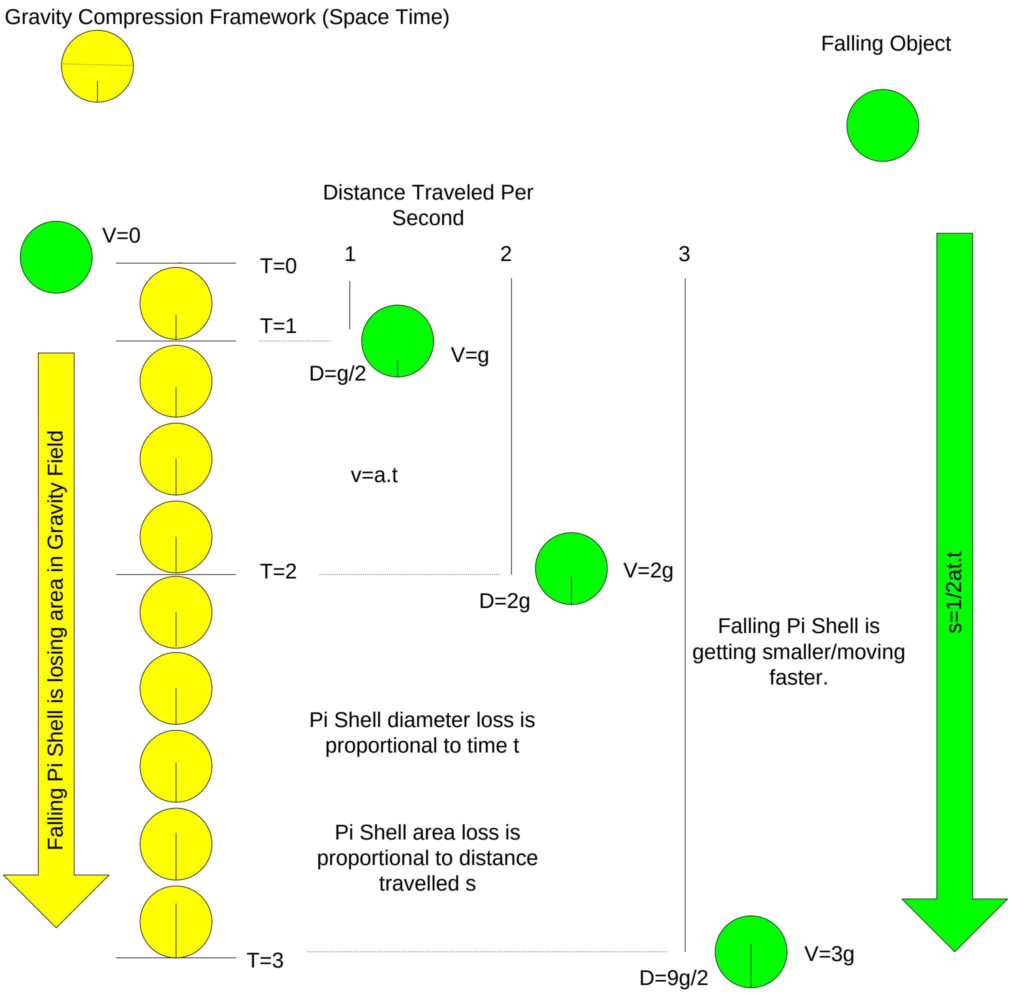
Therefore distance is proportional to the diameter squared which means distance is proportional to the area loss of the Pi-Shell as it accelerated or moves through a Gravity field (same thing). This assumption is based on using the Square Rule.

$$s \alpha diameter^2$$

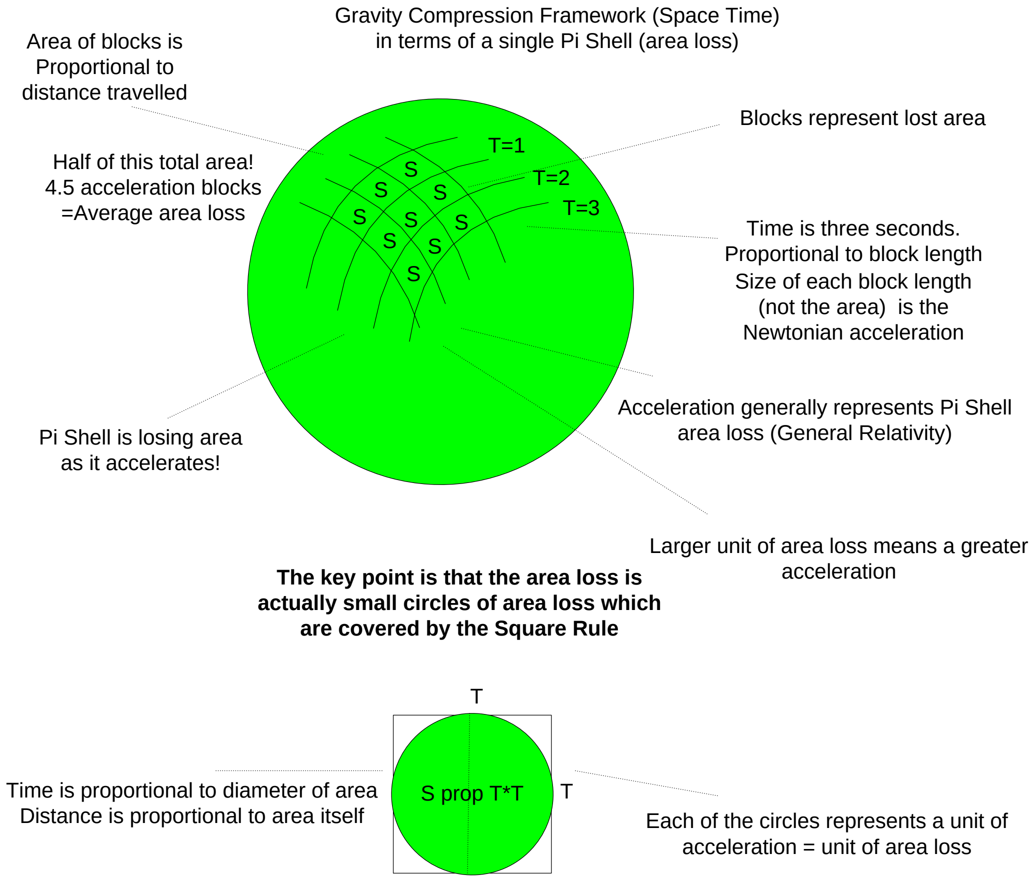
Therefore (using the Square Rule)

$$s \alpha areaLoss$$

By implication, when an object moves in Pi-Space, the QM Waves on the surface of the Pi-Shell are responsible for the distance that it travels. Also, the length of the clock tick is tied into the diameter change.



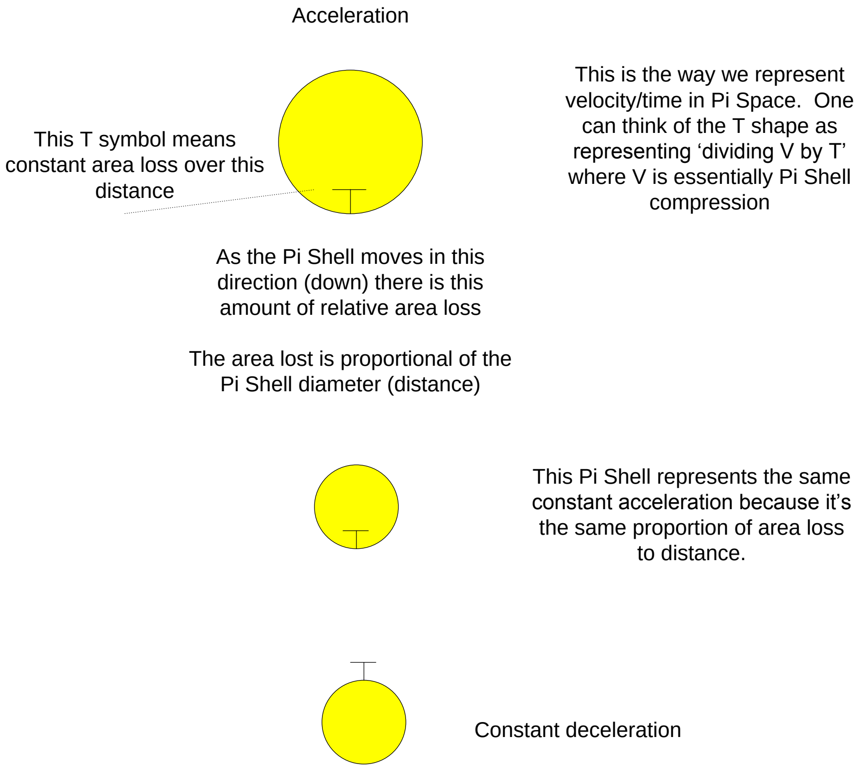
One can therefore consider Gravity in terms of a Pi-Shell losing area with respect to time and distance.



1.14 Pi-Shell Diagrams for Acceleration and Gravity

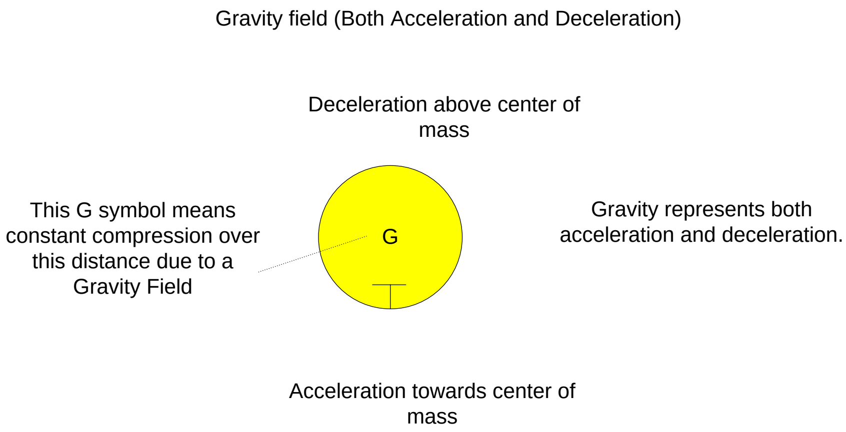
I have shown acceleration as a Pi-Shell sequence. How can one draw a single Pi-Shell and indicate that there is acceleration in a particular direction? In the case of Gravity, we know that for a distance d, there is a loss of area. This is expressed as a compression, expressed in terms of velocity v. The loss in area is directly proportional to the distance one travels, not the velocity line. We can use a Pi-Shell diagram to represent a Unit of Acceleration. This diagram is essentially the same as a velocity diagram except there is a horizontal line at the top of the compression line forming a letter T to indicate that this is the compression for this distance and in this direction.

Note: Although we're dealing with area loss, we express the area loss in terms of a velocity line.



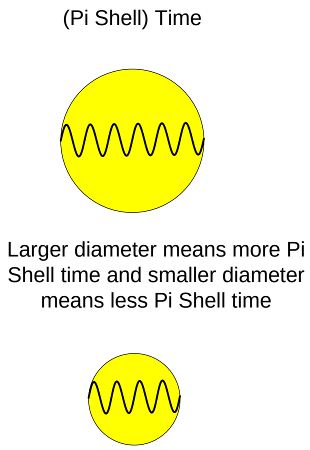
However, the problem with this diagram is that it represents *either* deceleration or acceleration but Gravity represents *both* acceleration and deceleration. If one moves upwards within a Gravity field, one decelerates and vice versa if one moves downwards. Therefore, a second notation is required. The first one describes acceleration / deceleration singularly and the second one describes both acceleration and deceleration in one notation. If one moves with the field there is acceleration. If one moves against the field, there is deceleration. One cannot place two 'T's on the same Pi-Shell because implicit in the 'T' is the vector component towards the vector of movement and they'll cancel each other out.

Therefore, a Gravity field (comprising acceleration and deceleration) is represented by a G symbol. If one moves up and down, there is deceleration above and acceleration below. The Pi-Shell acceleration/deceleration is essentially due to a Gravity field, identified by the letter 'G'.



1.15 Pi-Shell Diagram for Time

How can we represent time then? I have shown that time is a property of the diameter of the Pi-Shell. To represent time, take a Pi-Shell and add a wave function moving from one side of the Pi-Shell to the other. Events are essentially moving at the same speed 'C' in Space Time but Pi-Shells have different sizes. The events flow across a Pi-Shell diameter and the rate of events (Pi-Shell time) is proportional to the diameter of the Pi-Shell.



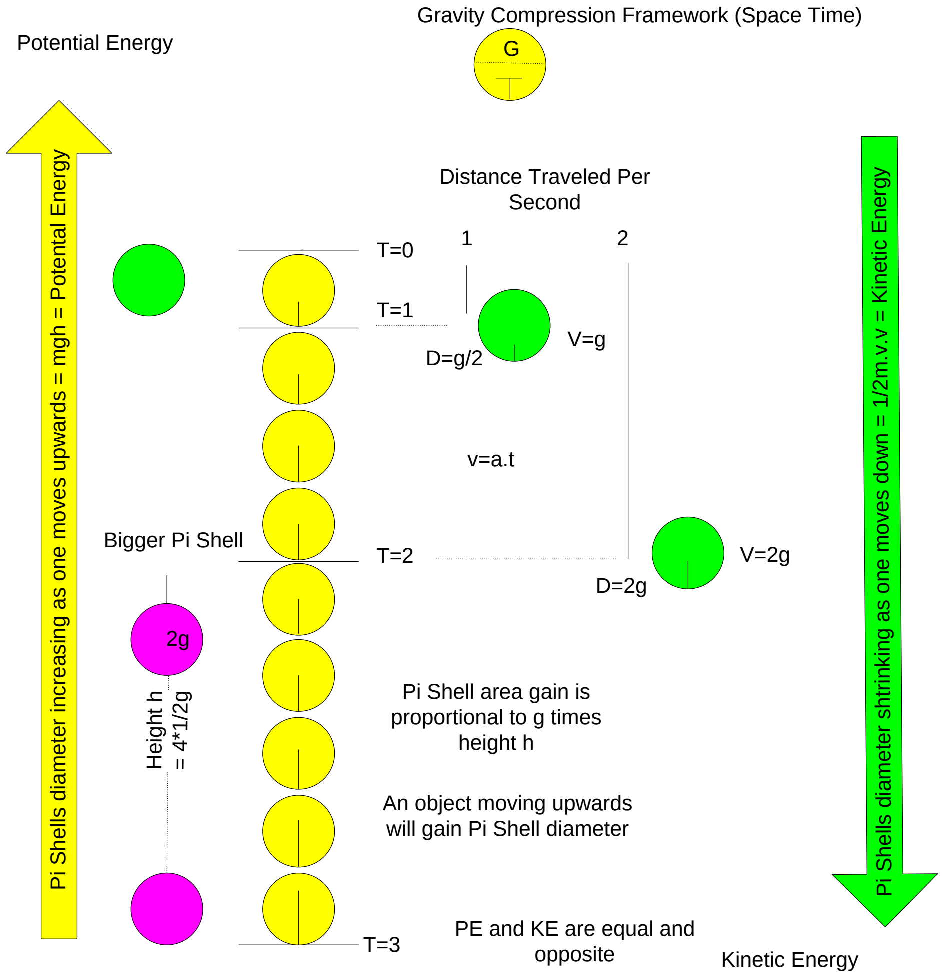
1.16 Understanding Potential Energy

Newton introduced the idea of Potential Energy. The classical example is the person on the roller-coaster. The person climbs to the top of the track and waits there for a moment. The person has no Kinetic Energy but has gained Potential Energy. As the roller-coaster goes down the track, Potential Energy drops and is converted into Kinetic Energy. As I have already described, Kinetic Energy is about Pi-Shells shrinking. *Therefore Potential Energy is about Pi-Shells getting larger as one moves upwards.* The energy part is determined by multiplying the mass by the change in diameter.

Newton's Potential Energy is non-relativistic and is governed by the formula

$$PotentialEnergy = mgh$$

In this case, m is the mass, g is the Gravitational Constant and h is the height relative to the notional observer. This formula maps reasonably easily to Pi-Space. As one moves upwards, the Pi-Shells are growing by Gravitational constant g which maps to a diameter change.



Note that the Potential Energy Pi-Shell uses the diameter line notation where the diameter line is outside the Pi-Shell. This indicates that the Observer Pi-Shell is getting larger (by the diameter line).

1.17 The Doppler Effect and Gravitational Time Dilation

The Doppler effect can be applied to two objects moving away from each other with relative velocity v. Hubble showed that as the universe expands there is red shift. The light is stretched the faster the object moves away and thus the wavelength lengthens relatively which produces red shift.

$$\omega = \omega_o \frac{1 + {}^{v}\!/_{c}}{\sqrt{1 - {}^{v^2}\!/_{c^2}}}$$

A Gravity field compresses Space Time and the Pi-Shells that reside within it. Also, the wavelength of light is also affected by a Gravity field. The higher ones moves in a Gravity field, the longer the wavelength because there is less compression due to Gravity. Therefore,

if one moves upwards in a Gravity field, there will be red shift of light. Additionally, a Pi-Shell's diameter will become larger. The ratio of gain of the diameter of a Pi-Shell and the increase in the wavelength of light is the same for both.

So what has this to do with Gravitational Time Dilation? The answer is that as one moves upwards, the Pi-Shell diameter gets larger; therefore there is more time per Pi-Shell and there is time dilation relating to the Gravity field. We can modify the Relativistic Doppler effect equation by replacing velocity line and expressing it in terms of the acceleration and time.

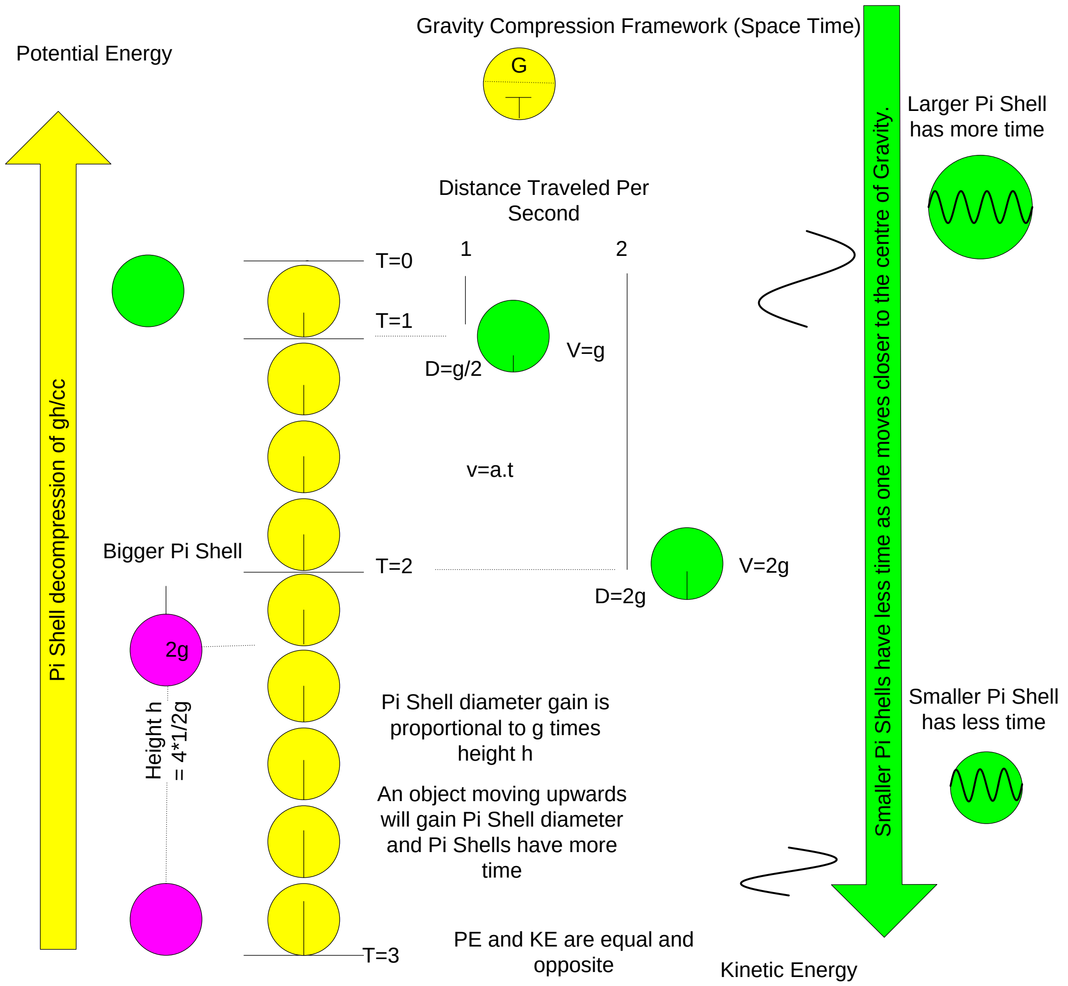
The velocity is assumed to be 'C' because we're dealing with light. h/C replaces time t.

$$\omega = \omega_o \frac{1 + {}^{gh}\!/_{c^2}}{\sqrt{1 - {}^{v^2}\!/_{c^2}}}$$

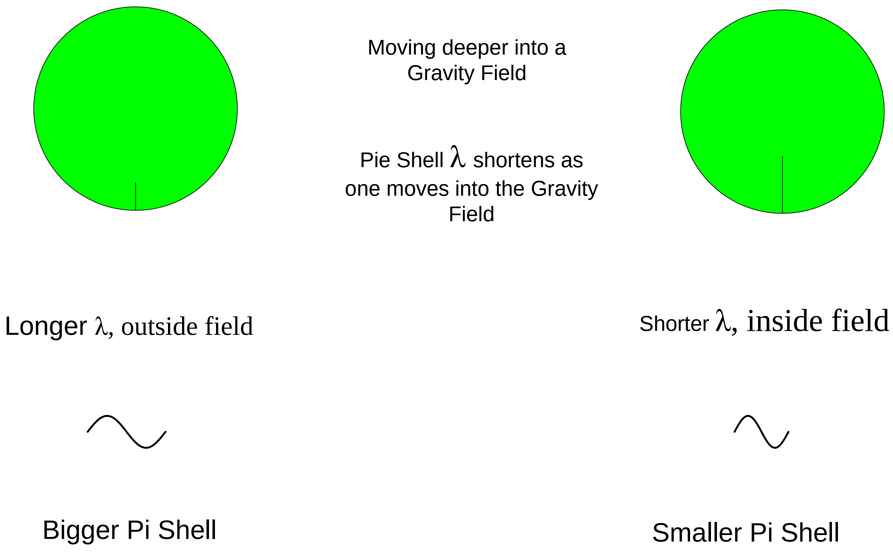
This simplifies to the following, where v<C (although I prefer the equation above because it is complete)

$$\omega = \omega_o (1 + {}^{gh}\!/_{c^2})$$

The important point in this formula is that gh expressed as a proportion of c^2 represents the additional change in compression as one moves upwards.


Gravity Compression Framework (Space Time)
G
Potential Energy
Larger Pi Shell
has more time
Distance Traveled Per
Second
1
2
T=0
T=1
D=g/2
V=g
v=a.t
Bigger Pi Shell
T=2
V=2g
D=2g
2g
Height h
= 4*1/2g
Pi Shell diameter gain is
proportional to g times
height h
An object moving upwards
will gain Pi Shell diameter
and Pi Shells have more
time
Smaller Pi Shell
has less time
T=3
PE and KE are equal and
opposite
Kinetic Energy
Pi Shell decompression of gh/cc
Smaller Pi Shells have less time as one moves closer to the centre of Gravity.

I've already shown that as a Pi-Shell moves faster, it has a shorter λ. The same is true of a Pi-Shell when it moves inside a Gravity field. The Pi-Shell grows smaller and the λ grows shorter. The deeper into a Gravity field a Pi-Shell goes, even if it remains stationary at a point within the Gravity field, its reduced λ remains. The rate of change is governed by the strength of the field itself.



As one falls under Gravity, ones velocity increases. Using the De Broglie formula, one can see that ones λ decreases also. If one suddenly stops at a particular point, then the λ remains fixed at that point. A Gravity Field fixes the λ of a Pi-Shell at a particular point (excluding external forces – this is handled by the General Relativity framework).

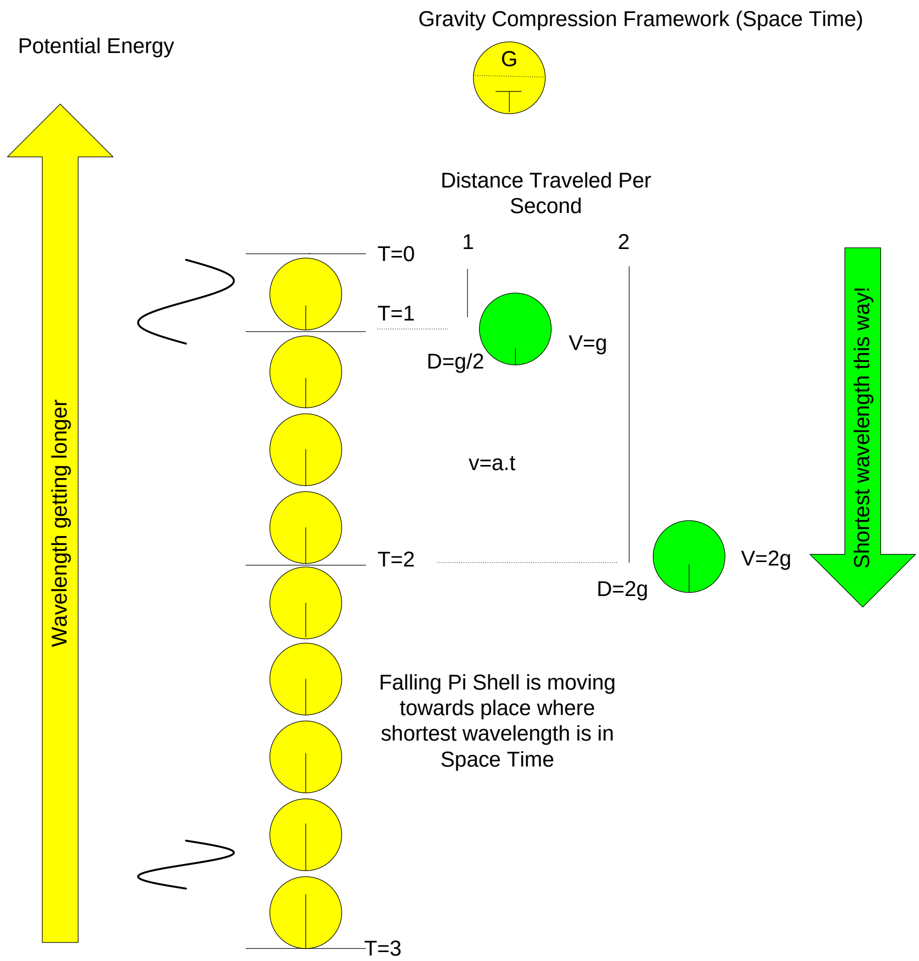
1.18 The Principle of Least Action and Minimizing Pi-Shell Time

One of the main weaknesses of the Newtonian view is that it does not describe why mass follows the path that it does as it falls under Gravity but rather how it falls. We all just know from experience that mass falls 'straight down'. Einstein improved the situation and came up with the term The Geodesic in General Relativity to come up with the reason why. He described the path that a particle follows under Gravity as The Geodesic. This is the shortest path the Pi-Shell can follow in curved Space Time. This idea is hard to visualize because curved Space Time is hard to visualize. One of the advantages of the Pi-Shell framework is that a Gravity field can be represented by Pi-Shells as I've illustrated. The Pi-Shells get smaller and consequent wavelength gets shorter.

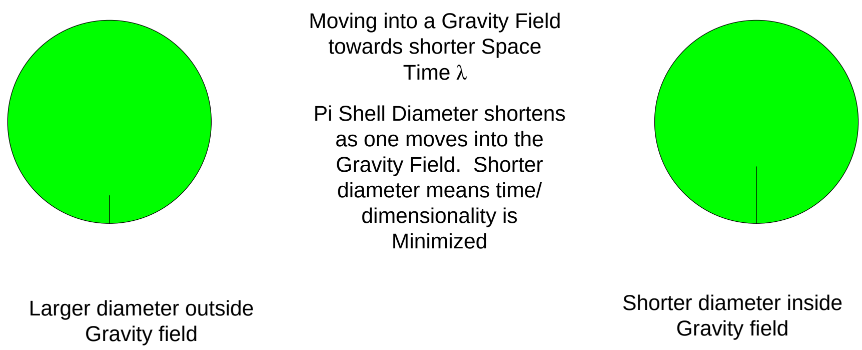
There is however another term to understand how mass falls under Gravity and it is covered by The Principle of Least Action which is a much older idea than Einstein's Geodesic. There are many who are attributed with this term; (originally coined by) Pierre Louis Maupertuis a student of Johan Bernoulli, (later used by) Hamilton, Lagrange, Euler, Leibniz, Fermat, Thomson and more recently Feynman (post Einstein).

This idea uses the following elementary idea: all that is happening in a Gravity field is some property of matter is being minimized. Which one is this? The answer is that time of the Pi-Shell is being minimized. Now, I have shown that time is a property of a Pi-Shell we can see

that what is being minimized is the diameter of the Pi-Shell. Therefore the Pi-Shell follows a path where the diameter of the Pi-Shell shrinks the most.



Therefore, the reason why Pi-Shells follow the path they do in a Gravity field is that they move in the direction where the shortest Space Time wavelengths are - which equates to the least action. This is the Principle of Least action understood in Pi-Space terms. Remember that the surface of Pi-Shells are composed of waves with wavelengths and so too is Space Time itself.

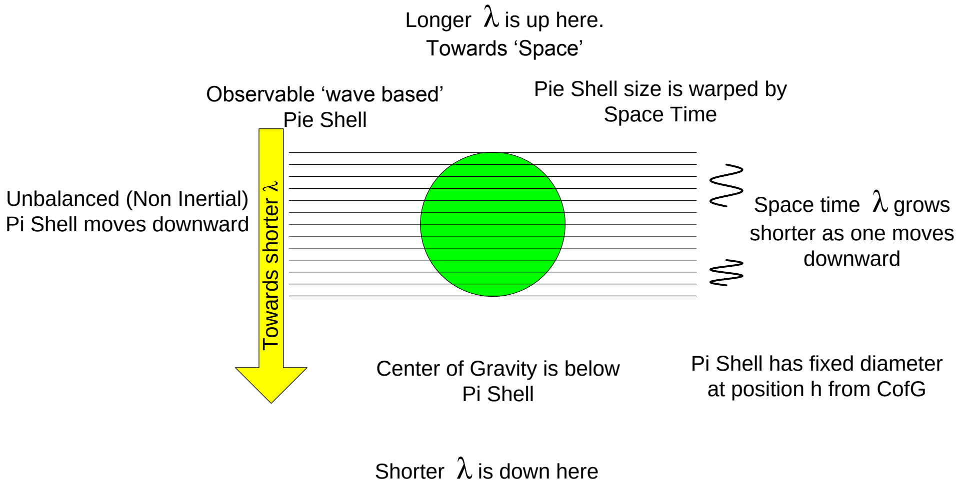


Although the falling Pi-Shell has a fixed λ (and diameter) based on its position in Space Time, the Space Time that resides inside the Shell itself is changing λ. The shortest λ is at the

bottom of the Pi-Shell and the largest λ is at the top. Therefore, warped Space Time *inside* the Pi-Shell is the reason for the Pi-Shell moving towards the center of Gravity. This is the Pi-Shell's guide, so to speak.

The key here is to identify two λ cases.

- The λs (more than one!) of Space Time inside the confines of a Pi-Shell
- The λ of the Pi-Shell itself which is definite for a particular position within Space Time



Please note that there are many other external events which cause a Pi-Shell to move in a particular direction, such as a collision with another Pi-Shell. However, the reason for the Pi-Shell to move in a particular direction *remains the same even in this other case!* This ties in with the Principle of Equivalence as I'll show. For now, in a Gravity field, the Pi-Shell moves towards the place in Space Time which has the shortest wavelength. As a consequence, the Pi-Shell shrinks as it moves closer to the center of Gravity.